

ATTACHMENT 7

United States
Environmental Protection
Agency

Office of Pesticides
and Toxic Substances
Washington, DC 20460

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Toxic Substances



Guidance for Controlling Asbestos-Containing Materials in Buildings



TABLE 5. COMPARISON OF METHODS FOR MEASURING AIRBORNE ASBESTOS

	PCM	SEM	TEM
Standard Methods	NIOSH P&CAM 239 Method. ¹	No standard method.	EPA provisional method & update. ²
Quality Assurance	Proficiency Analytical Testing Program; no NBS ³ reference materials.	No lab testing, or NBS reference materials.	Limited lab testing; NBS reference materials available.
Cost	\$25-50	\$50-300	\$200-600
Availability	Most available.	Less available.	Least available.
Time Requirements	1 hr. preparation & analysis, < 6 hrs. turnaround.	4 hrs. preparation & analysis, 6-24 hrs. turnaround.	4-24 hrs. preparation & analysis, 2-7 days turnaround.
Sensitivity (Thinnest Fiber Visible)	0.15 μm at best; 0.25 μm typical.	0.05 μm at best; 0.20 μm typical.	0.0002 μm at best; 0.0025 μm typical.
Specificity	Not specific for asbestos.	More specific than PCM but not definitive for asbestos.	Definitive for asbestos. when used to its fullest capabilities.

¹ NIOSH 1979. The new NIOSH 7400 method is an alternative.

² USEPA 1977, Yamate 1984.

³ National Bureau of Standards.

Source: Taken with modification from USEPA 1985b.

The SEM method can be somewhat more specific for asbestos and more sensitive to thin fibers than PCM, but less so than TEM. It is also less expensive and time-consuming than TEM. At present, however, no standard measurement protocol is available for SEM. As a result, it has not been systematically evaluated nor has the reliability of SEM measurements been established.

EPA acknowledges that all three methods are used in air testing for the purpose of releasing abatement contractors. However, only PCM and TEM have standard methods and testing programs. A standard method has not yet been developed for SEM. While TEM is technically the method of choice, PCM is the only option in many localities.

6.4.2.3 Recommended Test Specifications

Regardless of the microscopic method for measuring asbestos, identifying homogeneous work sites is the first important step in the process. A site within the abatement work area is homogeneous if it contains one type of ACM and only one type of abatement was used. For sampling purposes, the air in each

homogeneous site is assumed to be relatively uniform. Guidelines for locating the samplers are included in Appendix M. Several other aspects of the air test are identical, regardless of microscopic method:

- Choose sampling locations within the homogeneous work site to assure representative samples. (See Appendix M).
- Begin sampling when the work site is dry (24 hours after cleaning).
- Conduct aggressive air sampling in all cases.
- Follow sampling and analysis specifications, including procedures for quality control.

The asbestos program manager should be sure the technical advisor in charge of the air test knows the specifications listed below. The advisor should insist that recommended procedures be followed for both air sampling and laboratory analysis.

Testing with the TEM Method

Sampling:

- Draw at least 3000 liters of air through each filter at a rate of 2 to 12 liters per minute.
- Collect at least five samples in each homogeneous work site.
- At the same time, collect at least five samples just outside the work site but within the building. These samples will be compared with those collected inside the work site to ensure that the work site is at least as clean as the incoming air (see Appendix M for details).¹

Analysis:

- Measure the asbestos on each filter with TEM using the EPA provisional procedures and updates (USEPA 1977 and Yamate 1984).
- Use a direct transfer method of sample preparation if possible (see Appendix M).
- Express the results as f/cc, or as ng/m³ if an indirect sample preparation is used.
- Include at least one field blank ² and one laboratory blank per abatement job for quality control purposes (see Section 6.4.3). Also, split one work site sample and conduct duplicate analyses.

Release Criterion:

- Release the contractor if the average fiber concentration of the work site samples is not statistically larger than the average of the outside samples. Each homogeneous site must pass the test before the contractor is released. (Appendix M contains information to determine statistical differences.)
- If the average of the work site samples is statistically larger than the average of the outside samples, clean the entire work site again and repeat the test (collect new work site samples and follow the procedures described above).

¹ If a negative pressure system has not been used, collect the "outside" samples outdoors.

² A blank is a filter that is not used for sampling but is otherwise treated in the same way as other filters.

Testing with the PCM Method

Sampling:

- Draw at least 3000 liters of air through each filter at a rate of 2 to 12 liters per minute.
- Collect at least five samples per homogeneous work site, or one per room, whichever is greater.

Analysis:

- Measure the asbestos on each filter with PCM using the NIOSH P&CAM 239 procedures. (The newer NIOSH 7400 procedures can also be used. See Appendix M.)
- Include at least one field blank and one laboratory blank per abatement project, for quality control purposes. Also, split one work site sample for duplicate analysis.

Release Criterion:

- Release the contractor if every sample value is below the limit of reliable quantification (approximately 0.01 f/cc when 3000 liters of air are sampled; see Appendix M).
- If any of the sample values is above the prescribed level, clean the entire work site again, collect new samples, and evaluate the samples as described above.

For each method, the recommended number of samples and the prescribed use of the data defining the release criteria are based on a compromise involving practical considerations of cost, time required for the tests, performance characteristics of the methods, and statistical criteria. Details of the sampling and analysis specifications are provided in Appendix M.

6.4.3 Quality Assurance

Notwithstanding the advantages of one microscopic method over another, no method will produce reliable results unless both the field sampling and laboratory analysis are properly conducted. To obtain reliable results, a quality assurance (QA) program for the collection and analysis of data is essential.

The objective is to produce measurements with sufficient and documented quality for their intended purpose. In this case, the purpose is to determine satisfactory completion of an abatement project. The components of a QA program range from clerical activities such as labeling samples and documenting results, to performing technically complex tasks in the laboratory. When establishing the quality of data, however, all activities are equally important.

Preparing and implementing a QA program requires the assistance of a technical advisor on asbestos measurement. EPA and OSHA have published guidelines on quality assurance for TEM and PCM (Yamate 1984, and NIOSH 1979). The QA Program Checklist below can be used by the asbestos program manager in reviewing a proposed QA program.

QA Program Checklist

- **Training and Experience:** Be sure that all persons producing the measurement understand their roles and are trained. Select a laboratory with demonstrated proficiency in asbestos analysis. Request details of the laboratory's quality control program, and get documentation of the lowest level of fibers routinely reported.

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Asbestos
Inspection
Report

Part III

**Environmental
Protection Agency**

40 CFR Part 763

**Asbestos-Containing Materials in Schools;
Final Rule and Notice**

(b) The inspector shall classify and give reasons in the written assessment for classifying the ACBM and suspected ACBM assumed to be ACM in the school building into one of the following categories:

(1) Damaged or significantly damaged thermal system insulation ACM.

(2) Damaged friable surfacing ACM.

(3) Significantly damaged friable surfacing ACM.

(4) Damaged or significantly damaged friable miscellaneous ACM.

(5) ACBM with potential for damage.

(6) ACBM with potential for significant damage.

(7) Any remaining friable ACBM or friable suspected ACBM.

(c) Assessment may include the following considerations:

(1) Location and the amount of the material, both in total quantity and as a percentage of the functional space.

(2) Condition of the material, specifying:

(i) Type of damage or significant damage (e.g., flaking, blistering, water damage, or other signs of physical damage).

(ii) Severity of damage (e.g., major flaking, severely torn jackets, as opposed to occasional flaking, minor tears to jackets).

(iii) Extent or spread of damage over large areas or large percentages of the homogeneous area.

(3) Whether the material is accessible.

(4) The material's potential for disturbance.

(5) Known or suspected causes of damage or significant damage (e.g., air erosion, vandalism, vibration, water).

(6) Preventive measures which might eliminate the reasonable likelihood of undamaged ACM from becoming significantly damaged.

(d) The local education agency shall select a person accredited to develop management plans to review the results of each inspection, reinspection, and assessment for the school building and to conduct any other necessary activities in order to recommend in writing to the local education agency appropriate response actions. The accredited person shall sign and date the recommendation, provide his or her State of accreditation, and, if applicable, provide his or her accreditation number, and submit a copy of the recommendation to the person designated under § 763.84 for inclusion in the management plan.

§ 763.90 Response actions.

(a) The local education agency shall select and implement in a timely manner the appropriate response actions in this section consistent with the assessment

conducted in § 763.88. The response actions selected shall be sufficient to protect human health and the environment. The local education agency may then select, from the response actions which protect human health and the environment, that action which is the least burdensome method. Nothing in this section shall be construed to prohibit removal of ACBM from a school building at any time. should removal be the preferred response action of the local education agency.

(b) If damaged or significantly damaged thermal system insulation ACM is present in a building, the local education agency shall:

(1) At least repair the damaged area.

(2) Remove the damaged material if it is not feasible, due to technological factors, to repair the damage.

(3) Maintain all thermal-system insulation ACM and its covering in an intact state and undamaged condition.

(c)(1) If damaged friable surfacing ACM or damaged friable miscellaneous ACM is present in a building, the local education agency shall select from among the following response actions: encapsulation, enclosure, removal, or repair of the damaged material.

(2) In selecting the response action from among those which meet the definitional standards in § 763.83, the local education agency shall determine which of these response actions protects human health and the environment. For purposes of determining which of these response actions are the least burdensome, the local education agency may then consider local circumstances, including occupancy and use patterns within the school building, and its economic concerns, including short- and long-term costs.

(d) If significantly damaged friable surfacing ACM or significantly damaged friable miscellaneous ACM is present in a building the local education agency shall:

(1) Immediately isolate the functional space and restrict access, unless isolation is not necessary to protect human health and the environment.

(2) Remove the material in the functional space or, depending upon whether enclosure or encapsulation would be sufficient to protect human health and the environment, enclose or encapsulate.

(e) If any friable surfacing ACM, thermal system insulation ACM, or friable miscellaneous ACM that has potential for damage is present in a building, the local education agency shall at least implement an operations and maintenance (O&M) program, as described under § 763.91.

(f) If any friable surfacing ACM, thermal system insulation ACM, or friable miscellaneous ACM that has potential for significant damage is present in a building, the local education agency shall:

(1) Implement an O&M program, as described under § 763.91.

(2) Institute preventive measures appropriate to eliminate the reasonable likelihood that the ACM or its covering will become significantly damaged, deteriorated, or delaminated.

(3) Remove the material as soon as possible if appropriate preventive measures cannot be effectively implemented, or unless other response actions are determined to protect human health and the environment. Immediately isolate the area and restrict access if necessary to avoid an imminent and substantial endangerment to human health or the environment.

(g) Response actions including removal, encapsulation, enclosure, or repair, other than small-scale, short-duration repairs, shall be designed and conducted by persons accredited to design and conduct response actions.

(h) The requirements of this Subpart E in no way supersede the worker protection and work practice requirements under 29 CFR 1926.58 (Occupational Safety and Health Administration (OSHA) asbestos worker protection standards for construction), 40 CFR Part 763, Subpart G (EPA asbestos worker protection standards for public employees), and 40 CFR Part 61, Subpart M (National Emission Standards for Hazardous Air Pollutants—Asbestos).

(i) Completion of response actions. (1) At the conclusion of any action to remove, encapsulate, or enclose ACBM or material assumed to be ACBM, a person designated by the local education agency shall visually inspect each functional space where such action was conducted to determine whether the action has been properly completed.

(2)(i) A person designated by the local education agency shall collect air samples using aggressive sampling as described in Appendix A to this Subpart E to monitor air for clearance after each removal, encapsulation, and enclosure project involving ACBM, except for projects that are of small-scale, short-duration.

(ii) Local education agencies shall have air samples collected under this section analyzed for asbestos using laboratories accredited by the National Bureau of Standards to conduct such analysis using transmission electron microscopy (TEM) or, under circumstances permitted in this section,

laboratories enrolled in the American Industrial Hygiene Association Proficiency Analytical Testing Program for phase contrast microscopy (PCM).

(iii) Until the National Bureau of Standards TEM laboratory accreditation program is operational, local educational agencies shall use laboratories that use the protocol described in Appendix A to Subpart E of this part.

(3) Except as provided in paragraphs (i) (4), (5), (6), or (7) of this section, an action to remove, encapsulate, or enclose ACBM shall be considered complete when the average concentration of asbestos of five air samples collected within the affected functional space and analyzed by the TEM method in Appendix A of this Subpart E, is not statistically significantly different, as determined by the Z-test calculation found in Appendix A of this Subpart E, from the average asbestos concentration of five air samples collected at the same time outside the affected functional space and analyzed in the same manner, and the average asbestos concentration of the three field blanks described in Appendix A of this Subpart E is below the filter background level, as defined in Appendix A of this Subpart E, of 70 structures per square millimeter (70 s/mm²).

(4) An action may also be considered complete if the volume of air drawn for each of the five samples collected within the affected functional space is equal to or greater than 1,199 L of air for a 25 mm filter or equal to or greater than 2,799 L of air for a 37 mm filter, and the average concentration of asbestos as analyzed by the TEM method in Appendix A of this Subpart E, for the five air samples does not exceed the filter background level, as defined in Appendix A, of 70 structures per square millimeter (70 s/mm²). If the average concentration of asbestos of the five air samples within the affected functional space exceeds 70 s/mm², or if the volume of air in each of the samples is less than 1,199 L of air for a 25 mm filter or less than 2,799 L of air for a 37 mm filter, the action shall be considered complete only when the requirements of paragraph (i) (3), (5), (6), or (7) of this section are met.

(5) At any time, a local education agency may analyze air monitoring samples collected for clearance purposes by phase contrast microscopy (PCM) to confirm completion of removal, encapsulation, or enclosure of ACBM that is greater than small-scale, short-duration and less than or equal to 160 square feet or 260 linear feet. The action shall be considered complete when the results of samples collected in the

affected functional space and analyzed by phase contrast microscopy using the National Institute for Occupational Safety and Health (NIOSH) Method 7400 entitled "Fibers" published in the NIOSH Manual of Analytical Methods, 3rd Edition, Second Supplement, August 1987, show that the concentration of fibers for each of the five samples is less than or equal to a limit of quantitation for PCM (0.01 fibers per cubic centimeter (0.01 f/cm³) of air). The method is available at the Office of the Federal Register Information Center, 11th and L St., NW., Room 8401, Washington, DC, 20408, and the EPA OPTS Reading Room, Rm. G004 Northeast Mall, 401 M St., SW., Washington, DC 20460. This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR Part 51. The method is incorporated as it exists on the effective date of this rule, and a notice of any change to the method will be published in the Federal Register.

(6) Until October 7, 1989, a local education agency may analyze air monitoring samples collected for clearance purposes by PCM to confirm completion of removal, encapsulation, or enclosure of ACBM that is less than or equal to 3,000 square feet or 1,000 linear feet. The action shall be considered complete when the results of samples collected in the affected functional space and analyzed by PCM using the NIOSH Method 7400 entitled "Fibers" published in the NIOSH Manual of Analytical Methods, 3rd Edition, Second Supplement, August 1987, show that the concentration of fibers for each of the five samples is less than or equal to a limit quantitation for PCM (0.01 fibers per cubic centimeter, 0.01 f/cm³). The method is available at the Office of the Federal Register, 11th and L St., NW., Room 8301, Washington, DC, 20408, and in the EPA OPTS Reading Room, Rm. G004 Northeast Mall, 401 M St., SW., Washington, DC 20460. This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR Part 51. The method is incorporated as it exists on the effective date of this rule and a notice of any change to the method will be published in the Federal Register.

(7) From October 8, 1989, to October 6, 1990, a local education agency may analyze air monitoring samples collected for clearance purposes by PCM to confirm completion of removal, encapsulation, or enclosure of ACBM that is less than or equal to 1,500 square feet or 500 linear feet. The action shall be considered complete when the results of samples collected in the affected

functional space and analyzed by PCM using the NIOSH Method 7400 entitled "Fibers" published in the NIOSH Manual of Analytical Methods, 3rd Edition, Second Supplement, August 1987, show that the concentration of fibers for each of the five samples is less than or equal to a limit of quantitation for PCM (0.01 fibers per cubic centimeter, 0.01 f/cm³). The method is available at the Office of the Federal Register, 11th and L St., NW., Room 8301, Washington, DC, 20408, and in the EPA OPTS Reading Room, Rm. G004 Northeast Mall, 401 M St., SW., Washington, DC 20460. This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR Part 51. The method is incorporated as it exists on the effective date of this rule and a notice of any change to the method will be published in the Federal Register.

(8) To determine the amount of ACBM affected under paragraphs (i) (5), (6), and (7) of this section, the local education agency shall add the total square or linear footage of ACBM within the containment barriers used to isolate the functional space for the action to remove, encapsulate, or enclose the ACBM. Contiguous portions of material subject to such action conducted concurrently or at approximately the same time within the same school building shall not be separated to qualify under paragraphs (i) (5), (6), or (7) of this section.

§ 763.91 Operations and maintenance.

(a) *Applicability.* The local education agency shall implement an operations, maintenance, and repair (O&M) program under this section whenever any friable ACBM is present or assumed to be present in a building that it leases, owns, or otherwise uses as a school building. Any material identified as nonfriable ACBM or nonfriable assumed ACBM must be treated as friable ACBM for purposes of this section when the material is about to become friable as a result of activities performed in the school building.

(b) *Worker protection.* The protection provided by EPA at 40 CFR 763.121 for worker protection during asbestos abatement projects is extended to employees of local education agencies who perform operations, maintenance, and repair (O&M) activities involving ACM and who are not covered by the OSHA asbestos construction standard at 29 CFR 1926.58 or an asbestos worker approved by OSHA under section 19 of the Occupational Safety and Health Act. Local education agencies may consult